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Analysis of Telecommunication Data: Call Drop

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***Abstract*-----Today, cellular phones are the most commonly used wireless technology. Cellular phones are so common that it can be seen in everyone's hand whether it is old, young or teenagers. It is used for communication with each other at distant places, messaging each other and downloading and uploading data on the internet.**
Sometimes users faces some problems in communications like termination of call in between of communication, wrong connections, etc. which have an impact on the Quality of Service (QoS) of the mobile subscribers.
Of the numerous QoS parameter call drop i.e. any unexpected call termination of a mobile call before the caller party or the called party hang up the call. Users are sensitive towards the call drop than call blocking at the beginning of the call. It is a matter of concern for telecom industry as nothing is more important than customer satisfaction. Today call drop is such a big issue that TRAI (Telecom Regulatory Authority of India) has decided to charge service providers 1 Indian rupee per call drop occur.
It is the responsibility of the telecom service providers to improve their infrastructure to minimize the effect of call drop and provide quality services to their customers.
***Keywords*-----Call drop, failed call rate, quality of service (QoS), mobile station, BTS, MSC, BSC**

I. INTRODUCTION

Today most of the mobile subscribers are facing problem of an unexpected call termination of a call before the caller party or the called party finish their conversation and one of them hung up.
The issue of disconnection or termination of call is known as Call drop. The termination or disconnection of call in between the conversation has been increasing day by day which increases in the number of complaints by the subscriber.
The number of subscribers of telecom service providers are increasing day by day which effect an immense load on the telecom infrastructure which result in a dip in the quality of service provided.
Call drop rate is one of the key performance indicator (KPI) used by the network service operator for measuring the Quality of Service (QoS). Call drop, affects the quality of experience of the subscribers which can take place due to a variety of technical issues including inadequate coverage; problems with the quality of signals; interference; network congestion; shadowing; call handover; and network failure.
The subscriber at rural areas mainly faces call drops due to lack of coverage, while in urban areas; this can be due to the increase in the growth of subscriber base and lack of equal investment in the improvement of the infrastructure which includes setting up of base transceiver station (BTS) and establishing in building coverage.\

II. FACTORS CAUSING CALL DROPS

A. Demand of wireless cellular connectivity

Due to the increase in users demand of wireless cellular connectivity the cell size of cellular network is reduced to do so. Which results in increase in the numbers of handovers (moving from one cell to another cell) and the probability of call drop increases.

B. Signal strength

When a user enters an area which is out of coverage or having inadequate signal strength or the place where the signals are interfered, interrupted or jammed may cause call drop. This is like leaving the coverage area. Occasionally calls are dropped during handover or handoff procedure between cells. This is due to traffic imbalance in the cell site, when one cell site is handoff a call to another cell site and it's having its maximum capacity then call drop take place.

C. Network Configuration

There could be modifications in the old sites or even they are moved out of the existing network and introduce the new sites. This requires regular updation or reconfiguration of the existing network. Un-configured or non-updated network may cause the cell

unaware of the neighboring cell it is handover a call, results in call drop.

D. Transmission Problems

Call drop may occurs due faulty transceiver within base station and other hardware related reasons such as faulty transmission media and at the receiver end such as no power and abruptly stops transmitting.

E. Trans-receiver and receiver problem

In a cellular network, the difference between the uplink signal and the downlink signal level may be high which can further cause call drop, in the following situations:

1) The Transmit power of the BTS is high.
2) The tower mounted amplifier (TMA) or BTS amplifier malfunction.
3) The antenna and the connector are not properly connected. As a result, call drops may occur at the edge of the coverage area.

F. Propagation factors

Call failures can also occur due to propagation factors on signal behavior such as reflections and multipath, diffraction and shadowing, building and vehicle penetration, propagation of signal over water, propagation of signal over vegetation (foliage loss), fading of the signal, and interference. Generally more than 50% of the reasons for dropped calls[9] in a cell, are reported to be mainly due to electromagnetic causes, as shown at Table: 2.1.In some cases, where the networks use load control algorithm (typically located in the radio network controller), Calls can also be dropped to preserve system quality.

Table 2.1: Occurrence of Call Dropping in a Reference Cell

Drop Call causes	Occurrence (%)
Electromagnetic causes (RF related)	51.4
Irregular User behavior	36.9
Abnormal Network response	7.6
Others	4.1

G. Irregular user behavior

Call could also drop due to irregular user behavior such as mobile equipmentFailure, phones switched off after ringing, and finish of tariff plan etc. Other causes can be due to abnormal network response (e.g. radio and signaling protocol error).

III. CALL DROP RATE (CDR)

In telecommunications, the call drop rate (CDR) is the fraction of the telephone calls which, due to technical reasons, were cut off before the speaking parties had finished their conversational tone and before one of them had hung up (dropped calls) This fraction is usually measured as a percentage of all calls.

The formula for calculating the percentage of dropped call is:

=A/B*100

Where:

A=the total number of interrupted calls (dropped calls)

B=the total number of calls successfully established (where traffic channel is allotted)

IV. METHODS OF SOLVING CALL DROP PROBLEM

A. Dynamic Channel Allocation: The performanceof the network of the service provider is being measured by the probability of call drops due to handover in busy traffic hours.Many service providers have adopted the Time Division Access (TDMA) based dynamic channel allocation in heavy load conditions in order to reduce the call drop probability in their network. In TDMA a bandwidth window is applied which changes its size according to the changing traffic on the network. The high priority and real time handover calls i.e., voice and multimedia calls get the requested bandwidth while the lower priority handover calls i.e., Data calls get minimum bandwidth and the probability of dropping of handover calls is reduced to minimum and maximum number of users can be served by the network.

B. *Allocating multiple routes for same call:*The service providers can allocate multiple routes for the same call to reach its destination which will help in bypassing the congestion on a particular route. For example, if a call is routed by gateway say A to its destination and its lines are busy then the call can be sent by another gateway say B.

C. *Use of Signal Booster:*In the areas where the signal strength are weak signal boosters can be used. Signal strength is the measure of the connectivity of the mobile device to the network. Signal strength can be weak due to certain factors like interference, weather conditions, traffic on the network and other factors also.

D. *Hybrid Channel Allocation (HCA):*Another strategy which is commonly used by the service providers is the use of Hybrid Channel Allocation (HCA) strategies for channel allocation and queuing technique for the Quality of Service (QoS). HCA strategy considers new calls in Fixed Channel Allocation (FCA) method and handoff calls in Dynamic Channel Allocation (DCA) method to reduce the probability of call blocking and call dropping. The application of queuing technique applied to HCA strategy increases theefficiency of the cellular system performance and effectively utilizing available allocated radio spectrum. This leads to decrease in call blocking and dropping and an increased capacity for users in the available channels.

E. *Prioritization Schemes[3]:*Completing an ongoing call is most desirable than accepting a new call, for this prioritization of handoff calls over new calls is employed. Such schemes allows high utilization of bandwidth while guaranteeing the quality of service of handoff calls. Basic methods of handoff prioritization schemes are auxiliary station, guard channels, call admission control (CAC), handoff queuing schemes. Some of these schemes can be combined together to getbetter results.

1) *Scheme 1: Measurement-Based Prioritization Scheme (MBPS)[4]:*It employs a dynamic priority queuing discipline instead of First In First Out (FIFO). It uses a signal prediction priority queuing (SPPQ) scheme to improve MBPS algorithm by using both Received Signal Strength (RSS) and the change in RSS (ΔRSS) to determine the priority ordering in the handoff queue.

2) *Scheme 2: Guard- Channel Prioritization Scheme:*Guard Channel schemes improve the probability of successful handoffs by simply reserving a number of channels exclusively for handoff in each cell. Remaining channels are shared equally between handoff and new calls. Guard channels are established only when the number of free channels is equal to or less thanthe predefined threshold. Guard channels are feasible because new calls areless sensitive to delay than the handoffs. To overcome the poor utilization of bandwidth, the dynamic guard channel scheme can be used.

3) *Scheme 3: Queuing Handoff Calls:* Queuing handoff call prioritization scheme queues the handoff calls and when a channel is released, it is assigned only to one of the handoff calls in the priority queue. The Handoff queuing technique reduces the call blocking rate, as new calls are not assigned a channel until all the handoff requests in the queue are served.In the handoff queuing schemes when the received signal strength of the BSC in the current cell reaches a certain defined threshold, the call is queued from a neighbouring cell in the same BSC. Then, a new call request is assigned a channel if the queue is empty or if there is at least one freechannel in the BSC. The calls would be queued until either a channel is available in the new cell or the power by the base station in the current cell drops below the receiver threshold signal. If the call reaches the receiver threshold and no free channel is found then the call is blocked. Queuing handoff is possible due to overlapping regions between the adjacent cells in which the mobile station can communicate with more than one base station (BS). First in First Out (FIFO) scheme is the most common queuing scheme.

4) *Scheme 4: Using Auxiliary Station[5]:* If large number of calls arrive at the base station, some of them could be blocked due to congestion. To reduce these problems, auxiliary stations are used. When call arrives and base station is not free then these new calls are engaged by auxiliary stations and as soon as the auxiliary station finds that the base station has freechannel, it transfers the call to the base station.

5) *Scheme 5: Call Admission Control (CAC) Protocol:* The Call Admission Control (CAC) scheme refers to the task of deciding whether new calls are admitted into the network or not. In this scheme the arrival of new calls is estimated and some calls are blocked if they are higher than the predefined threshold levelirrespective of whether channel is availableor not to decrease the probability of call drop due to handoff calls. In the CAC both the new calls and handoff calls have access to all channels. If new call that is generated in cell cannot find the idle channel, the call is dropped immediately if there is no queue provided for the new calls to wait.

6) *Improvement in Infrastructure:* Improvements in Tower and related infrastructure are elementary solutions which are needed to be in place for assuring reliability of telecom services. Certain new technologies can also be considered for supplementing infrastructural developments for better optimization of resources.

V. CONCLUSION

This paper provides the reasons of call drop and basis for resolving the same. It provides a summarized view of the problem of call dropping, how it occurs and what are the methods which can be opt to improve the telecom infrastructure and minimize the call drop. Hence, improve the quality of service provided. It may help the peoples who are working in telecom sector. Almost every telecom sector worldwide are upgrading their network infrastructure to reduce or minimize the problem of call drop.

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